US009158180B2

(12) **United States Patent**
Baker et al.

(10) **Patent No.: US 9,158,180 B2**
(45) **Date of Patent: Oct. 13, 2015**

(54) **LIGHT FOCUSING DEVICE**

(75) Inventors: **John B. Baker**, Watsonville, CA (US); **Erik Sowder**, Watsonville, CA (US)

(73) Assignee: **ExpoImaging, Inc.**, Watsonville, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **13/619,282**

(22) Filed: **Sep. 14, 2012**

(65) **Prior Publication Data**

US 2014/0079381 A1 Mar. 20, 2014

(51) **Int. Cl.**

G03B 11/00	(2006.01)
G03B 15/03	(2006.01)
G03B 17/12	(2006.01)

(52) **U.S. Cl.**

CPC ***G03B 15/03*** (2013.01); ***G03B 17/12*** (2013.01); *G03B 2215/0514* (2013.01); *G03B 2215/0592* (2013.01)

(58) **Field of Classification Search**

USPC 396/25–29, 155, 174–178, 198, 199, 396/544; 348/370, 371, 373–376; 362/3, 362/198, 16–18

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,017,727	A *	4/1977	Yamamoto	362/16
5,337,104	A *	8/1994	Smith et al.	396/199
5,437,104	A	8/1995	Chien	
6,029,011	A	2/2000	Sato	
7,748,858	B2	7/2010	Fong	
7,983,552	B2 *	7/2011	Moon et al.	396/155
2005/0259409	A1	11/2005	Pohlert et al.	
2008/0181598	A1 *	7/2008	Kobre	396/174
2012/0099849	A1	4/2012	Onishi et al.	
2013/0010134	A1	1/2013	Motoki et al.	
2013/0010185	A1	1/2013	Motoki et al.	
2014/0009671	A1	1/2014	Ozone et al.	
2014/0064718	A1	3/2014	Imafuji et al.	

FOREIGN PATENT DOCUMENTS

JP	2007-065081	A	3/2007
JP	2007-139871	A	6/2007
KR	10-2012-00266 87	*	3/2012

OTHER PUBLICATIONS

KR10-2012-0026687 Machine Translation.*

International Searching Authority, International Search Report and Written Opinion, PCT/US2013/059311, Dec. 16, 2013, 18 pages.

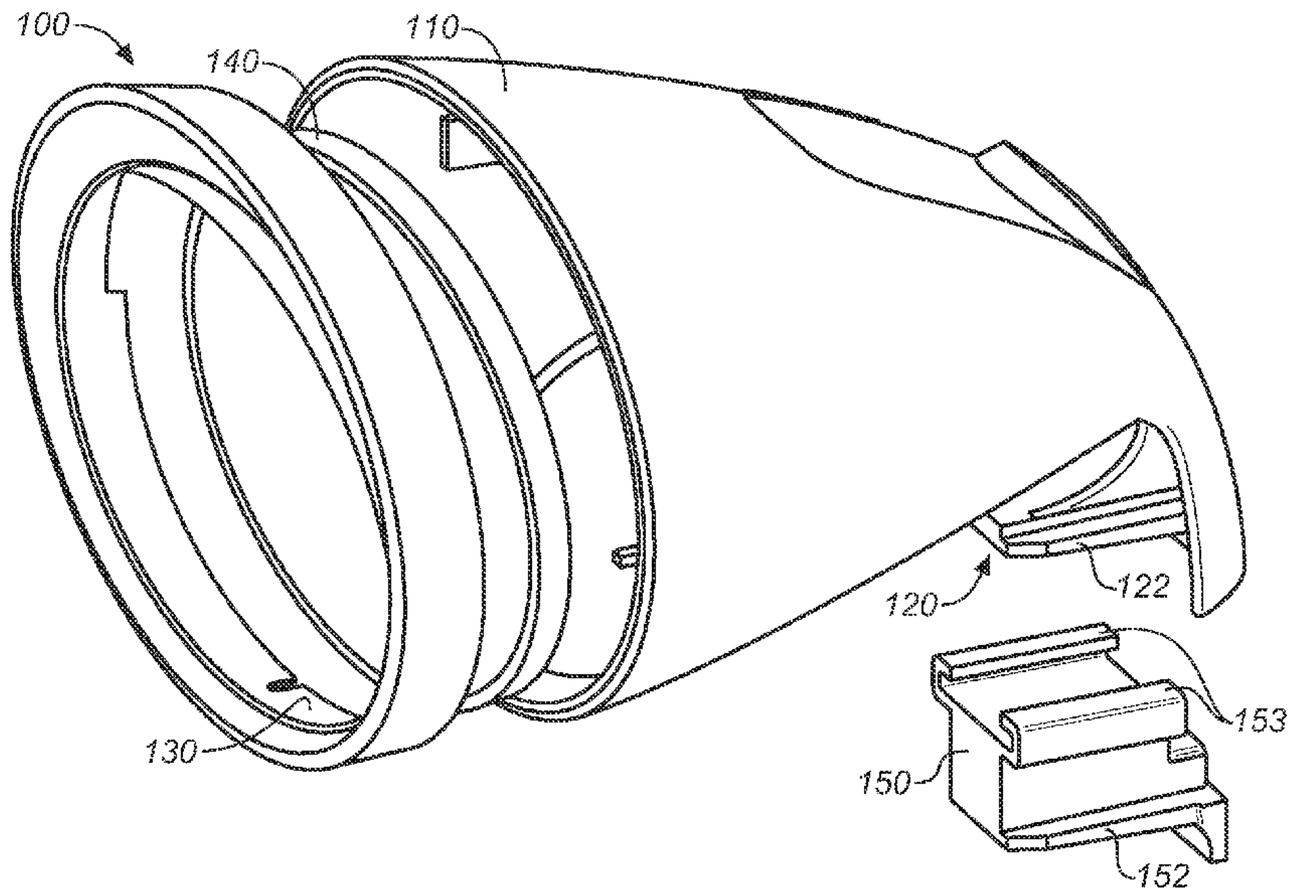
* cited by examiner

Primary Examiner — Minh Phan

(57) **ABSTRACT**

A light focusing device for detachably coupling to a camera with a built-in flash. The device comprises a mount for detachably coupling to the camera; a housing coupled with the mount, the housing configured to enclose the built-in flash when the built-in flash is an enabled position; and a lens coupled with the housing such that light generated by the built-in flash is focused by the lens such that intensity of the light is increased farther away than what the built-in flash is able to do on its own.

21 Claims, 5 Drawing Sheets



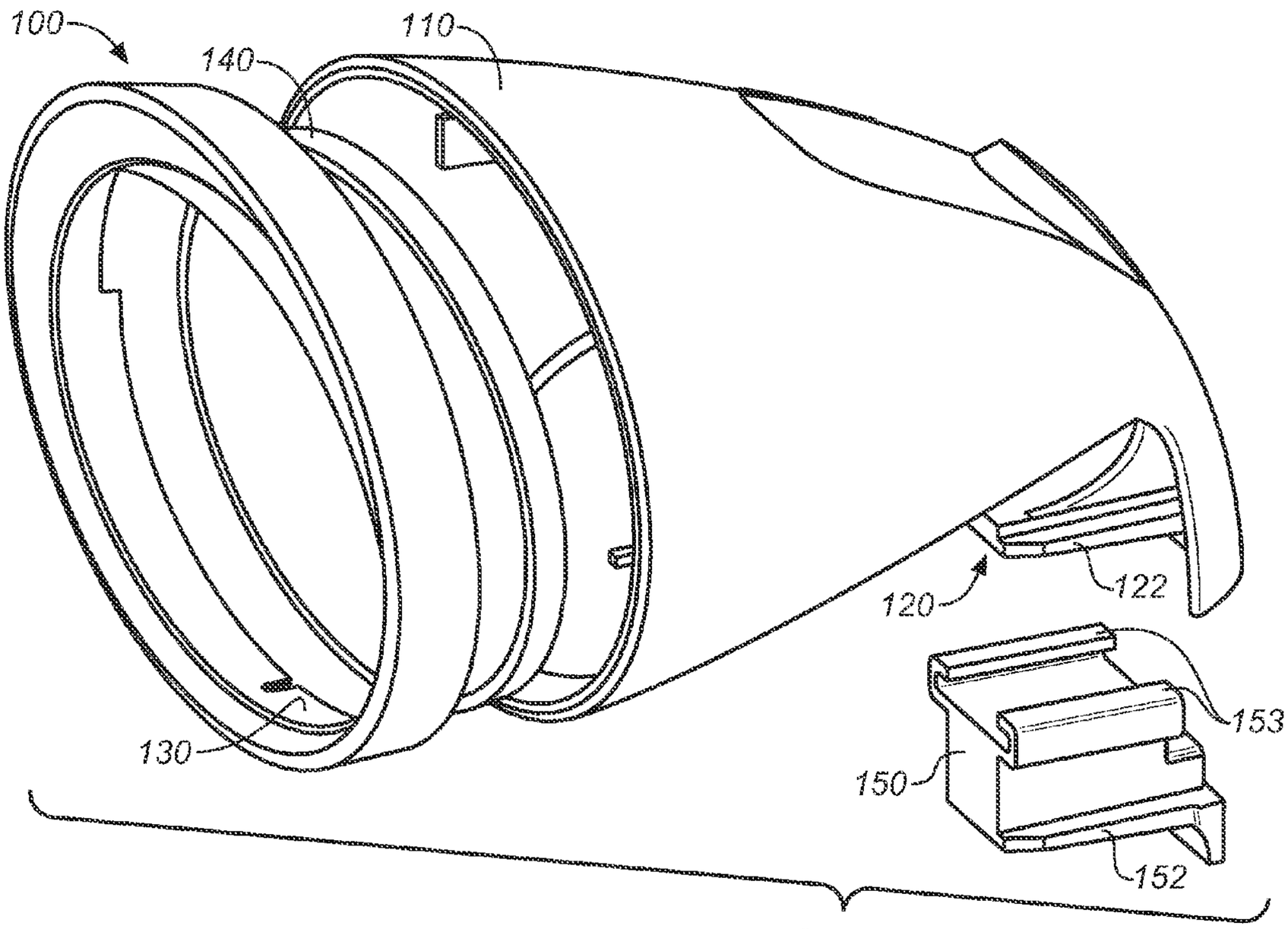


FIG. 1

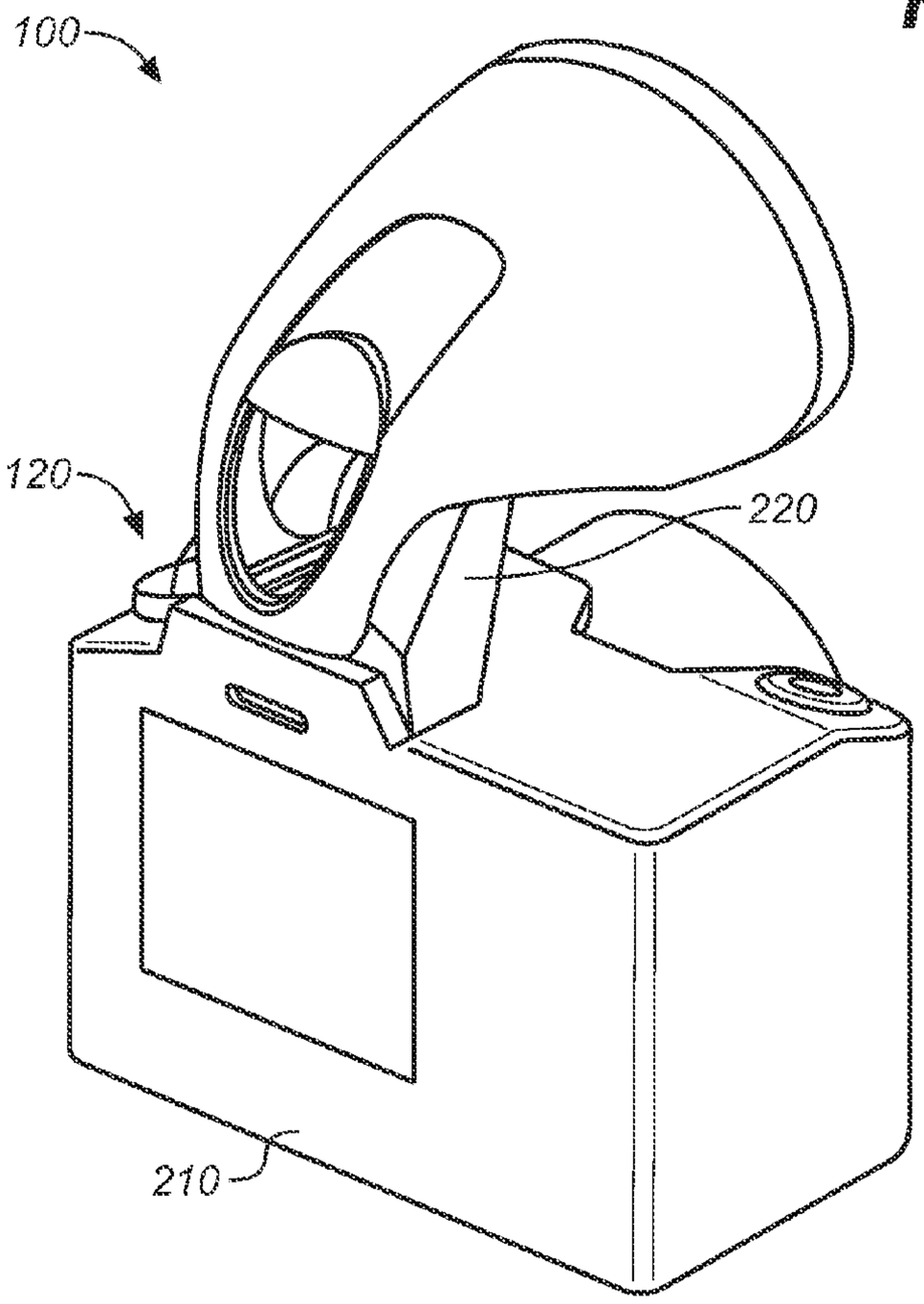


FIG. 2A

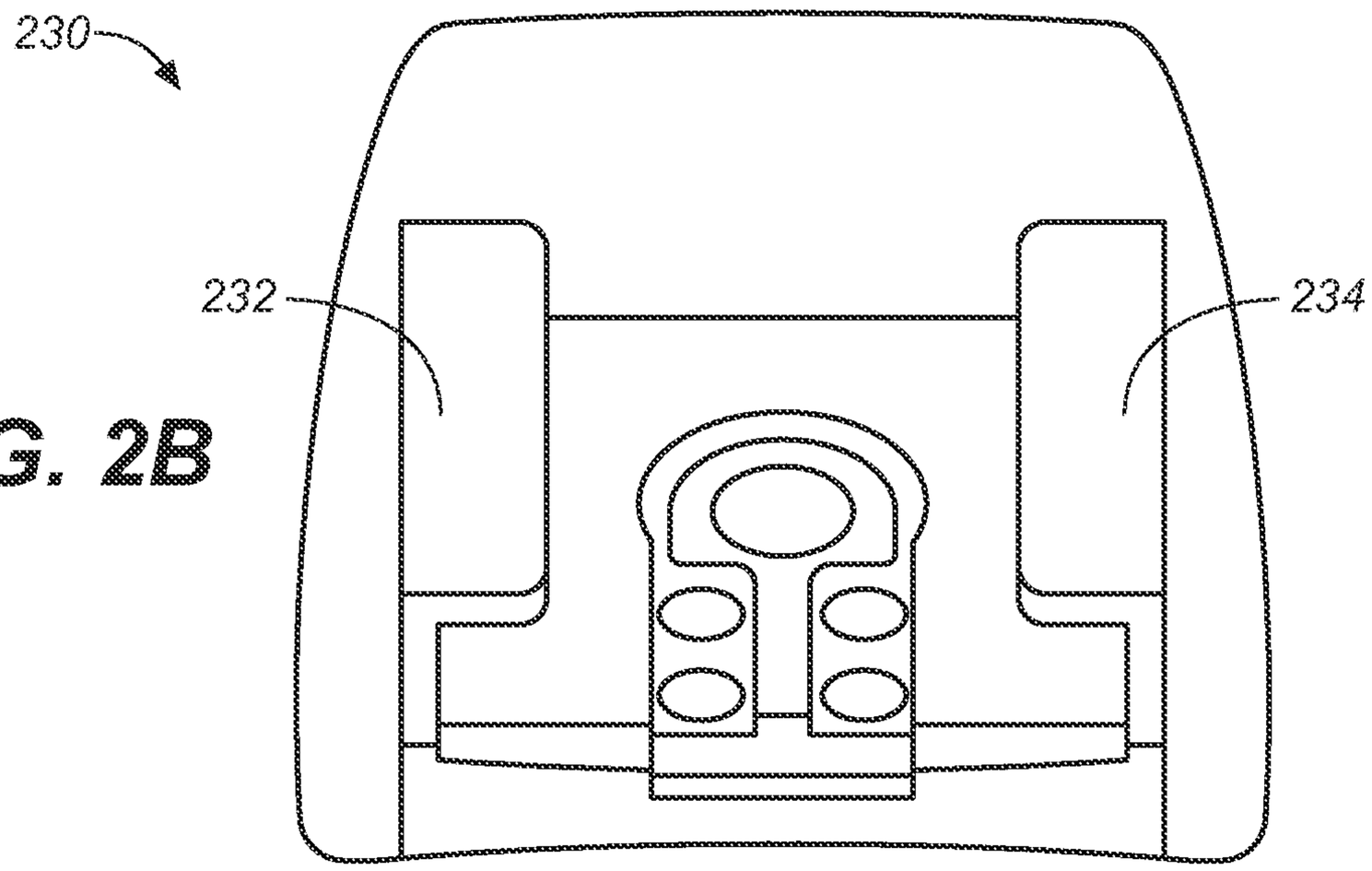


FIG. 2B

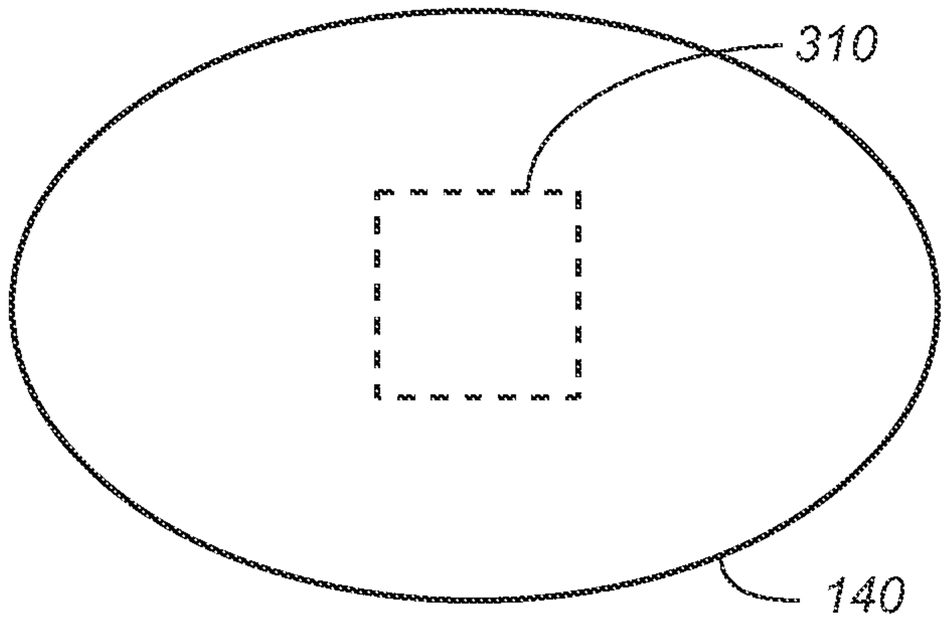


FIG. 3

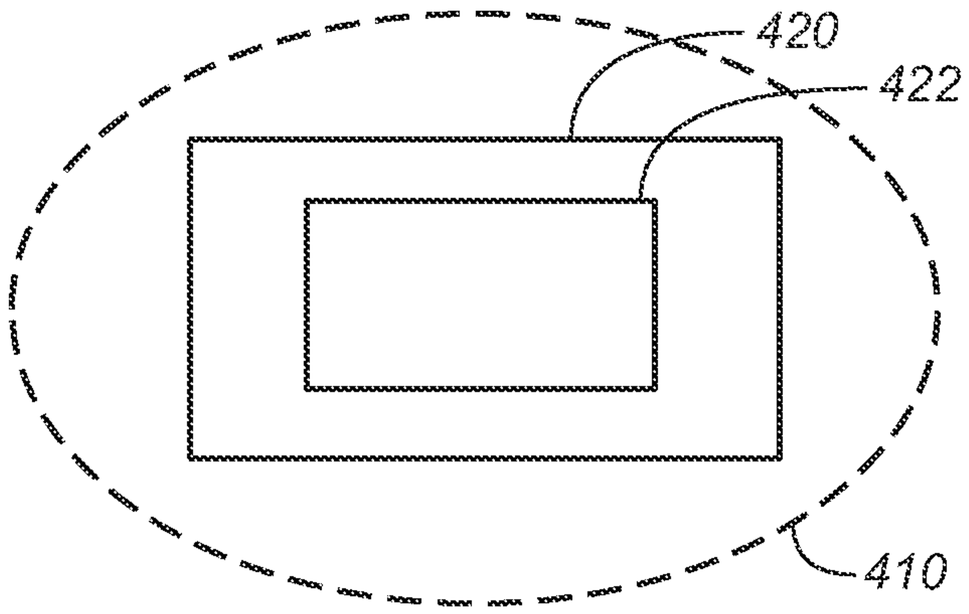


FIG. 4

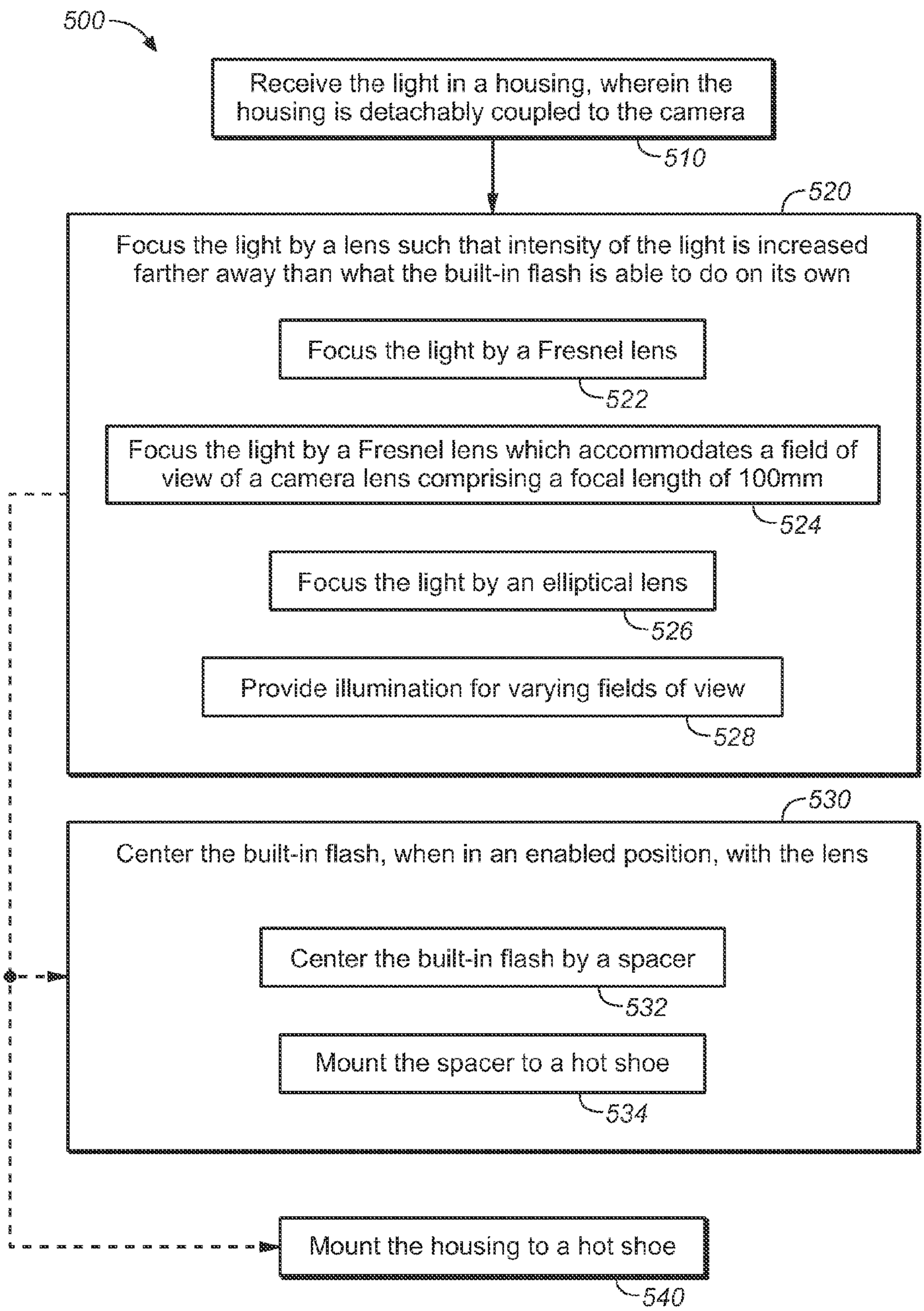

500
Receive the light in a housing, wherein the housing is detachably coupled to the camera
510
520
Focus the light by a lens such that intensity of the light is increased farther away than what the built-in flash is able to do on its own
Focus the light by a Fresnel lens
522
Focus the light by a Fresnel lens which accommodates a field of view of a camera lens comprising a focal length of 100mm
524
Focus the light by an elliptical lens
526
Provide illumination for varying fields of view
528
530
Center the built-in flash, when in an enabled position, with the lens
Center the built-in flash by a spacer
532
Mount the spacer to a hot shoe
534
Mount the housing to a hot shoe
540

FIG. 5

640A

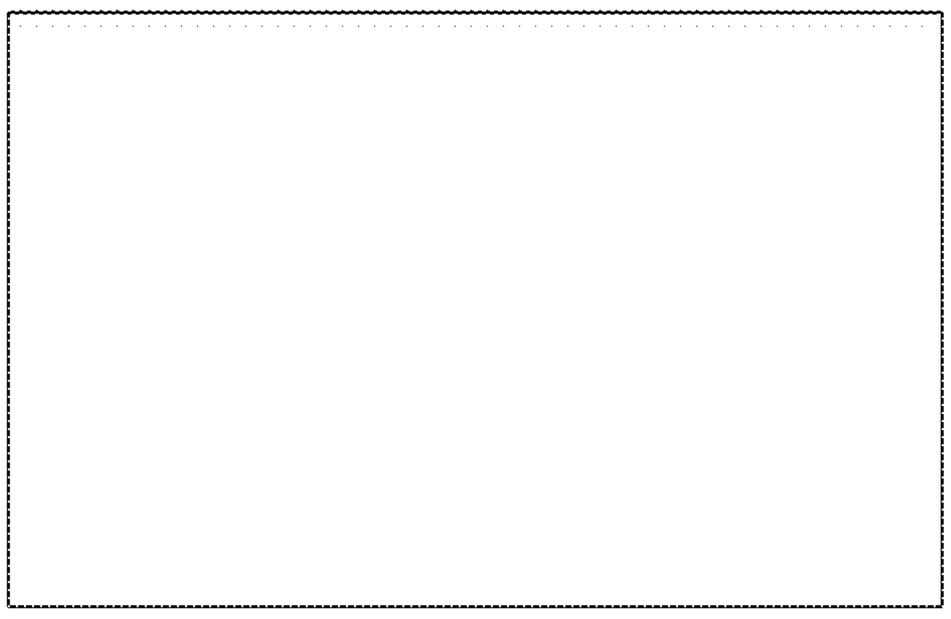


Figure 6A

640B

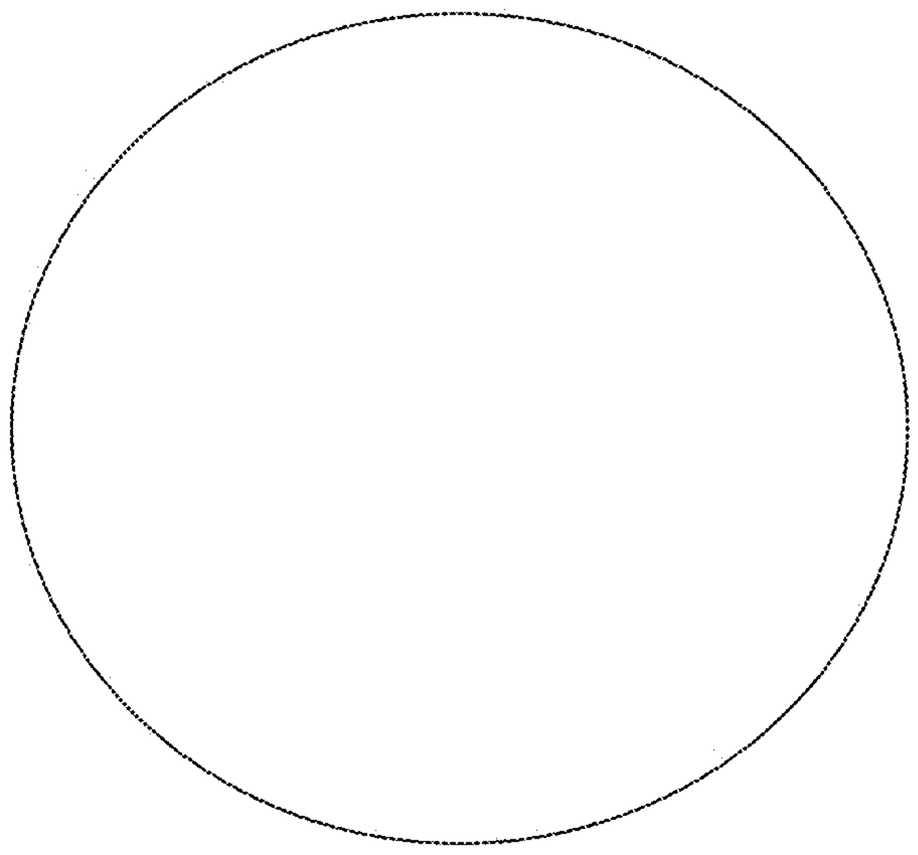


Figure 6B

LIGHT FOCUSING DEVICE

BACKGROUND

This invention relates to the modification of light from a photographic flash built in to a camera.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. **1-2**A illustrates embodiments of a light focusing device.

FIG. **2**B illustrates an embodiment of a hot shoe.

FIG. **3** illustrates an embodiment of a lens and a photographic flash centered behind the lens.

FIG. **4** illustrates an embodiment of a light spread.

FIG. **5** illustrates an embodiment of a method for focusing light.

FIG. **6**A-B illustrates embodiments of a lens.

The drawings referred to in this description should be understood as not being drawn to scale except if specifically noted.

BRIEF DESCRIPTION

Reference will now be made in detail to embodiments of the present technology, examples of which are illustrated in the accompanying drawings. While the technology will be described in conjunction with various embodiment(s), it will be understood that they are not intended to limit the present technology to these embodiments. On the contrary, the present technology is intended to cover alternatives, modifications and equivalents, which may be included within the spirit and scope of the various embodiments as defined by the appended claims.

Furthermore, in the following description of embodiments, numerous specific details are set forth in order to provide a thorough understanding of the present technology. However, the present technology may be practiced without these specific details. In other instances, well known methods, procedures, components, and circuits have not been described in detail as not to unnecessarily obscure aspects of the present embodiments.

In general, the use of photographic flash can enable photographers to shoot with a faster shutter speed, to freeze motion and to fill in shadows. Certain types of photography, for instance, wildlife photography and sports photography, benefit from the ability to project strobe light (e.g., a photographic flash) at a distance.

Typically, light emitted from a conventional built-in flash is spread out at a wide angle and does not provide sufficient illumination and intensity for objects at a distance from the camera.

Conventional flash modifiers for built-in flash are primarily diffusers or reflectors. That is, these modifiers attempt to soften or spread out light to make the light more flattering for portraiture by diffusing the light through a translucent material or by reflecting it off walls or ceilings.

Rather than diffuse or reflect light, the light focusing device, described herein, substantially improves the ability of a conventional built-in flash to project light at a distance by using a lens to efficiently focus the light into the reduced field of view presented by a zoom lens.

FIG. **1** depicts an exploded isometric view of an embodiment of light focusing device **100**. Device **100** includes housing **110**, mount **120**, bezel **130**, lens **140** and optionally, spacer **150**.

In general, light focusing device **100** is for receiving light generated by a flash (e.g., built-in flash) of a camera, and focusing and concentrating the light at a distance which is further than what the flash is able to provide on its own, which will be described in further detail below. In other words, light focusing device **100**, combined with a photographic flash, acts somewhat like a spotlight and provides sufficient illumination to illuminate objects a greater distance away from the camera than what the flash is able to provide on its own.

Referring to FIGS. **1-2**B, device **100** is detachably mounted to camera **210**. Camera **210** can be any camera that includes flash, such as a built-in flash. For example, camera **210** can be, but is not limited to, a digital single-lens reflex (DSLR) camera or a mirrorless camera.

Camera **210** includes hot shoe, such as hot shoe **230**, as depicted in FIG. **2**B. A hot shoe is a mounting point on top of a camera that allows for accessories to be mounted to the camera. The hot shoe also has electrical contacts that allow for electrical communication between the accessory and the camera. It is noted that device **100** is not electrically connected to the camera when mounted in the hot shoe.

Device **100** is detachably connected to a hot shoe via mount **120**. For example, feature **122** of mount **120** slides under features **232** and **234** of hot shoe **230**, such that mount **120** is physically mounted or seated in hot shoe **230**. It should also be appreciated that device **100** can also be connected to various mounts, such as, but not limited to a cold shoe or an eyepiece mount. A cold shoe is similar to a hot shoe except that a cold shoe does not have electrical contacts.

Housing **110** is configured to enclose built-in flash **220** when built-in flash **220** is an enabled position. Typically, the built-in flash is a pop-up unit on top of the camera (e.g., DSLR camera) and is used to supply illumination when the ambient lighting conditions drop below a certain level or when a photographer desires to use flash for creative effect. This level can be determined by the camera's exposure meter or can be manually selected by a photographer.

When in an enabled position, the built-in flash is in an extended position, as shown in FIG. **2**A. When not in use, or in a disabled position, the built-in flash is typically in a retracted position. For example, the built-in flash is retracted and seated into the housing of the camera.

Typically, when accessories are mounted into the hot shoe, the enablement of the built-in flash is disabled. That is, the built-in flash is disabled from being extended into the enabled position. However, this disabling feature can be overridden. In particular, when mount **120** is seated into the hot shoe the built-in flash is able to be extended into the enabled position and is able to emit light.

Housing **110** positions the lens at an efficient distance from the flash, centers the lens in front of the flash and prevents light from being directed outside the lens. Housing **110** controls the light such that it is projected substantially forward towards lens **140**. In contrast, a light emitted from a conventional flash is projected at a wide angle from the flash.

In one embodiment, housing **110** is a semi-conical shape with an elliptical end. It should be appreciated that housing **110** can be any shape that is conducive to controlling the light such that it is projected forward (in front of the camera) and directly towards lens **140**.

Housing **110** is also adjustable. For example, housing **110** adjusts to allow the lens **140** to be adjusted forward, backwards, up and/or down in relation to the hot shoe mount.

Lens **140** is disposed at a distal end of housing **110**. In one embodiment, bezel **130** facilitates in seating lens **140** in housing **110**. For example, lens **140** is detachably disposed between bezel **130** and the distal end of housing **110**.

Lens **140** is configured to control and focus the light from the flash such that the light is optimally projected to improve the quality of light from the camera. For example, by utilizing device **100**, the light generated by the flash is captured and concentrated such that the intensity of light is increased farther away from the camera as compared to what the built-in flash is able to do on its own.

The flash or bulb **310** of the built-in flash is centered with lens **140**, as depicted in FIG. **3**. If the built-in flash, when in the enabled position, is not centered with lens **140**, then the intensity of light and the light pattern projected from device **100** will not be optimal; the amount of light may be decreased and the pattern of light may not be uniform.

In one embodiment, spacer **150** facilitates in centering the flash with lens **140**. For example, feature **122** seats with feature **153** of spacer **150**, while feature **152** seats with features **232** and **234** of hot shoe **230**.

Lens **140** is designed such that it is has an optimum light spread for a field of view of the camera. In particular, the lens of the camera has a focal length which creates a particular field of view. Accordingly, lens **140** is designed such that the light focused by lens **140** fits the particular field of view of the lens of the camera.

In one embodiment, lens **140** is a Fresnel lens. For example, an elliptical Fresnel lens. In general, a Fresnel lens comprises concentric grooves molded into the surface of the lens material. The grooves act as individual refracting surfaces (e.g., prisms) that focus the emitted light.

It should be appreciated that lens **140** may be any lens that focuses light, as described herein, such as but not limited to a meniscus lens.

It should be appreciated that lens **140** may be any shape that is conducive to focusing the emitted light, as described herein. For example, the shape of lens **140** may be, but is not limited to a rectangular shape (e.g., lens **640**A in FIG. **6**A) and a circular shape (e.g., lens **640**B in FIG. **6**B).

In another embodiment, lens **140** has a thickness of about 1.5 mm with a focal length in the range of 2-3 inches. In a further embodiment, lens **140** is an injection molded polycarbonate. It should be appreciated that lens **140** may be comprised of various materials, such as, but not limited to plastic, glass, acrylic, etc.

FIG. **4** depicts an embodiment of the light spread **410** (or a spot of light), of device **100**, with respect to various fields of view (e.g., field of view **420** and field of view **422**) of the camera.

Device **100** generates light spread **410** that is larger than the field of views **420** and **422** so that there is even illumination across the whole frame at the given focal lengths. In one embodiment, device **100** generates a focused spot of light that sufficiently illuminates objects in the range of 75-100 feet away from the camera. In contrast, the built-in flash, alone, is usually designed to effectively illuminate objects no further than about 25-30 feet from the camera and does not sufficiently illuminate objects beyond that range.

In various embodiments, field of view **420** is a field of view for a lens having a focal length of 50 millimeter (mm) and a 3.2 aspect ratio; and field of view **422** is a field of view for a lens having a focal length of 200 mm and a 3.2 aspect ratio. Focal length describes the field of view that is seen. As such, the larger the focal length the narrower the field of view. In various embodiments, light spread **410** is able to provide proper light intensity and illumination for a lens focal length in the range of 50 mm to 200 mm. Other lens focal lengths could also be optimized using other embodiments.

FIG. **5** depicts an embodiment of method **500** for focusing light generated by a built-in flash of a camera. In some embodiments, method **500** is performed at least by light focusing device **100**, as depicted in at least FIG. **1**.

At **510** of method **500**, light is received in a housing, wherein the housing is detachably coupled to the camera. For example, housing **110** is detachably coupled to camera **210**. Also, light emitted by built-in flash **220** is received in the housing.

At **520**, light is focused by a lens such that intensity of the light is increased farther away than what the built-in flash is able to do on its own. For example, lens **140** is able to focus the light such that objects are sufficiently illuminated at a distance in the range of 75 feet to 100 feet.

In one embodiment, at **522**, light is focused by a Fresnel lens. For example, lens **140** is a Fresnel lens.

In another embodiment, at **524**, the light is focused by a Fresnel lens which accommodates a field of view of a camera lens comprising a focal length of 100 mm. For example, with reference to FIG. **4**, the Fresnel lens generates light spread **410** (or a spot of light) such that field of view **420** (e.g., a field of view for a lens with a 100 mm focal length) has even illumination across the whole frame.

In a further embodiment, at **526**, light is focused by an elliptical lens. For example, lens **140** is an elliptical lens.

In one embodiment, sufficient illumination is provided for varying fields of view. For example, with reference to FIG. **4**, lens **140** generates sufficient light spread **410** such that fields of view **420** and **422** have even illumination across the whole frame.

At **530**, the built-in flash, when in an enabled position, is centered with the lens. For example, with reference to FIG. **3**, the bulb or flash, when it is in the extended and enabled position, is centered with lens **140**.

In one embodiment, at **532**, the built-in flash is centered by a spacer. For example, spacer **150** raises the device **100** up (away from the hot shoe) such that the built-in flash is centered with the lens.

In another embodiment, at **534**, the spacer is mounted to a hot shoe. For example, spacer **150** (which detachably coupled to mount **120**) is mounted in hot shoe **230** such that the built-in flash is centered with the lens.

At **540**, the housing is mounted to a hot shoe. For example, housing **110** is mounted to hot shoe **230** (via mount **120**) such that device **100** is detachably coupled to camera **210**.

It should be appreciated that embodiments, as described herein, can be utilized or implemented alone or in combination with one another. While the present invention has been described in particular embodiments, it should be appreciated that the present invention should not be construed as limited by such embodiments, but rather construed according to the following claims.

The invention claimed is:

1. A light focusing device for detachably coupling to a camera with a built-in flash comprising:

a mount for detachably coupling to said camera, said mount configured to engageably mount into a hot shoe;

a housing coupled with said mount, said housing comprises an opening configured to receive said built-in flash when said built-in flash is in an enabled position; and

a lens coupled with said housing such that light generated by said built-in flash is focused by said lens such that intensity of said light is increased farther away than what said built-in flash is able to do on its own.

2. The light focusing device of claim **1**, wherein said built-in flash, when in said enabled position, is centered with said lens.

3. The light focusing device of claim 1, wherein said lens is selected from a group consisting of: a Fresnel lens, and a meniscus lens.

4. The light focusing device of claim 1, wherein said lens accommodates a field of view of a camera lens comprising a focal length of 100mm.

5. The light focusing device of claim 1, wherein said lens is selected from a group consisting of: an elliptical lens, a circular lens, a rectangular lens.

6. The light focusing device of claim 1, further comprising:

a spacer for centering said built-in flash, when in said enabled position, and said lens.

7. The light focusing device of claim 6, wherein said spacer is configured to mount in said hot shoe.

8. The light focusing device of claim 1,

wherein said housing is an adjustable housing allowing a distance of the lens to be adjusted in relation to said hot shoe.

9. The light focusing device of claim 1, wherein said lens is detachably coupled to said housing.

10. The light focusing device of claim 1, wherein said lens is disposed at a distal end of said housing.

11. The light focusing device of claim 1, wherein said lens is selected from a group consisting of: a polycarbonate lens, an acrylic lens, a glass lens, and a plastic lens.

12. A method for focusing light generated by a built-in flash of a camera, said method comprising:

mounting a housing to a hot shoe, said housing comprising an opening configured to receive said built-in flash when said built-in flash is in an enabled position;

receiving said light in a housing, wherein said housing is detachably coupled to said camera; and

focusing said light by a lens such that intensity of said light is increased farther away than what said built-in flash is able to do on its own.

13. The method of claim 12, further comprising:

centering said built-in flash, when in an enabled position, with said lens.

14. The method of claim 12, further comprising:

centering said built-in flash by a spacer.

15. The method of claim 14, further comprising:

mounting said spacer to said hot shoe.

16. The method of claim 12, wherein said focusing said light by a lens, further comprises:

focusing said light by a Fresnel lens.

17. The method of claim 12, wherein said focusing said light by Fresnel lens, further comprises:

focusing said light by an Fresnel lens which accommodates a field of view of a camera lens comprising a focal length of 100mm.

18. The method of claim 12, wherein said focusing said light by a lens, further comprises:

focusing said light by an elliptical lens.

19. The method of claim 12, wherein said focusing said light by a lens, further comprises:

providing illumination for varying fields of view.

20. A light focusing device for emulating a light emitting device that is detachably coupled to a camera with a built-in flash comprising:

a mount for detachably coupling to said camera, said mount configured to engageably mount into a hot shoe;

a housing coupled with said mount, said housing comprises an opening configured to receive said built-in flash when said built-in flash is in an enabled position; and

a lens coupled with said housing such that light generated by said built-in flash is focused by said lens such that intensity of said light is increased farther away than what said built-in flash is able to do on its own emulating the light emitting device.

21. A method for emulating a light emitting device by focusing light generated by a built-in flash of a camera, said method comprising:

mounting a housing to a hot shoe, said housing comprising an opening configured to receive said built-in flash when said built-in flash is in an enabled position;

receiving said light in a housing, wherein said housing is detachably coupled to said camera; and

emulating the light emitting device by focusing said light by a lens such that intensity of said light is increased farther away than what said built-in flash is able to do on its own.

* * * * *